Evidence for Acid-Sulfate Alteration in the Pahrump Hills Region, Gale Crater, Mars

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The Pahrump Hills region of Gale crater is a ~12 m thick section of sedimentary rock in the Murray formation, interpreted as the basal geological unit of Mount Sharp. The Mars Science Laboratory, *Curiosity*, arrived at the Pahrump Hills in September 2014 and performed a detailed six-month investigation of the sedimentary structures, geochemistry, and mineralogy of the area. During the campaign, *Curiosity* drilled and delivered three mudstone samples (targets Confidence Hills, Mojave 2, and Telegraph Peak) to its internal instruments, including the CheMin XRD/XRF. Results from CheMin show that these samples have variable amounts of plagioclase, pyroxene, iron oxides, jarosite, phyllosilicates, cristobalite, and X-ray amorphous material. The presence of jarosite in all samples indicates these rocks were affected by acid-sulfate alteration, and the mineralogical and geochemical trends observed through the section may give more insight into this process. Geochemical data measured by APXS show enrichment in Si and depletion in Mg moving up section. CheMin data show that cristobalite is more abundant up section, whereas pyroxene and phyllosilicates are more abundant at the bottom of the section. Based on mineralogical and geochemical trends and diagenetic features observed in the Pahrump Hills, we hypothesize that the sediments were altered *in-situ* by acid-sulfate fluids moving down from the top of the section to leach mobile elements, dissolve the minerals most susceptible to acidic alteration, and precipitate secondary silica at the top of the section. Alternative interpretations of the observed mineralogical and geochemical data are possible, including the hypothesis that the redox conditions of the body of water in which the sediments were deposited changed over time.